of this section shall be used to compute the maximum permissible interference power level in all cases, unless the applicant demonstrates to the Commission that a different set of values for these parameters is more appropriate for his particular case. Where a symbol appears in table 1 of this section, the actual value of the parameter represented by the symbol is to be used.

Section 25.252 Table 1. Parameters to be used in the calculation of the maximum permissible interference power level and minimum permissible basic transmission loss

| Frequency band (MHz) | 3,700–4,200 | 5,925–6,425 | 6,625–7,125 | 10,950–11,200 | 11,450–12,200 | 12,500–12,750 | 14,000–14,500 |
|---|---|---|---|---|---|---|---|
| Interference path | T→E | E→T | T→E | T→E | T→E | E→T | E→T |
| $p_o$ (percent) | 0.03 | 0.01 | 0.03 | 0.03 | 0.03 | 0.01 | 0.01 |
| $n$ | 3 | [1] 2<br>[2] 4 | 3 | 2 | 2 | [1] 2<br>[2] 4 | [1] 2<br>[2] 4 |
| $n_{20}$ | 3 | [1] 2<br>[2] 4 | 3 | 2 | 2 | [1] 2<br>[2] 4 | [1] 2<br>[2] 5 |
| Interference parameters and criteria | | | | | | | |
| $p$ (percent) | 0.01 | [1] 0.005<br>[2] 0.0025 | 0.01 | 0.015 | 0.015 | [1] 0.005<br>[2] 0.0025 | [1] 0.004<br>[2] 0.0025 |
| $J$(dB) | 8.5 | 16.0 | 8.5 | 8.5 | 8.5 | 16.0 | 16.0 |
| $M_o(p_o)$ | 17.0 | 17.0 | 17.0 | 17.0 | 17.0 | 17.0 | 17.0 |
| $W$(dB) | 4.0 | 0.0 | 4.0 | 4.0 | 4.0 | 0.0 | 0.0 |

NOTE 1: This value should be used for international systems.
NOTE 2: This value should be used for domestic systems.
E=Earth Station.
T=Terrestrial Station.

| Frequency band | 3,700–4,200 | 5,925–6,425 | 6,625–7,125 | 10,950–11,200 | 11,450–12,200 | 12,500–12,750 | 14,000–14,500 |
|---|---|---|---|---|---|---|---|
| Interference path | T→E | E→T | T→E | T→E | T→E | E→T | E→T |
| Reference bandwidth, B (Hz) | $10^6$ | $4\times10^3$ | $10^6$ | $10^6$ | $10^6$ | $4\times10^3$ | $4\times10^3$ |
| System noise temperature, $T_r$ (°K) $T_r$ | $T_r$ | 750 | $T_r$ | $T_r$ | $T_r$ | 1,500 | 1,500 |
| $P_t$ (dBW) | 13 | *PE* | 9 | 5 | 5 | *PE* | *PE* |
| $G_t$ [3] (dBi) | 42 | $GE(\alpha)$ | 46 | 50 | 50 | $GE(\alpha)$ | $GE(\alpha)$ |
| $G_r$ [3] (dBi) | $GE(\alpha)$ | 45.0 | $GE(\alpha)$ | $GE(\alpha)$ | $GE(\alpha)$ | 50.0 | 50.0 |
| $P_{max}(\pi)$(dBW) | $10 \log_{10}(T_r)$ | −131 | $10 \log_{10}(T_r)$ | $10 \log_{10}(T_r)$ | $10 \log_{10}(T_r)-164$ | −128 | −128 |
| $L_w$(dB) | 0 | [4] $L_w$ | 0 | 0 | 0 | [4] $L_w$ | [4] $L_w$ |
| $S$ (dBW) | ............. | 173 | ............. | ............. | ............. | 175 | 175 |
| $E$ (dBW) | 55 | ............. | 55 | 55 | 55 | ............. | ............. |

NOTE 3=$GE$ ($\alpha$) is the gain of the earth station antenna toward the horizon at the azimuth of interest $\alpha$, and can be derived using the methods of § 25.253 (b).
NOTE 4=For interference analysis, actual line loss should be used, if known, if not known, assume 0 dB.

(d) In cases where an earth station or a terrestrial station may employ more than one type of emission, the parameters chosen for analysis should correspond to that pair of emissions which results in the greatest coordination distance.

[38 FR 8575, Apr. 4, 1973, as amended at 39 FR 33527, Sept. 18, 1974; 57 FR 21214, May 19, 1992]

## § 25.253 Determination of coordination distance for near great circle propagation mechanisms.

(a) The requirement that the interference power at the input to the receiver of the potentially interfered-with station be less than the maximum permissible interference power level $P_{max}(p)$ for all but p percent of the time (as determined in § 25.252), is equivalent to the requirement that a minimum permissible basic transmission loss between the two stations be exceeded for all but p percent of the time. For uniformity and convenience, this minimum permissible basic transmission loss is determined for each azimuth for $p$=0.01 percent of the time, at a frequency of 4 GHz. This value is termed the normalized basic transmission loss $L_o$ (0.01), and can be calculated from the formula:

$$L_o(0.01)=P_t+G_t+G_r-P_{max}(p)-F(p)-20\log_{10}(f/4)-L_w$$

where:

$P_t$=maximum available transmitting power (in dBW) in the reference bandwidth B, at the input to the antenna of the potentially interfering station. The representative value contained in the appropriate column of table 1 of § 25.252 should be used;

$G_t$=gain (in dB relative to an isotropic radiator) of the transmitting antenna of the potentially interfering station;

$G_r$=gain (in dB relative to an isotropic radiator) of the receiving antenna of the potentially interfered-with station;

$P_{max}(p)$=maximum permissible interference power (in dBW) in the reference bandwidth B of the potentially interfered-with station not to be exceeded for all but $p$ percent of the time as determined from § 25.252;

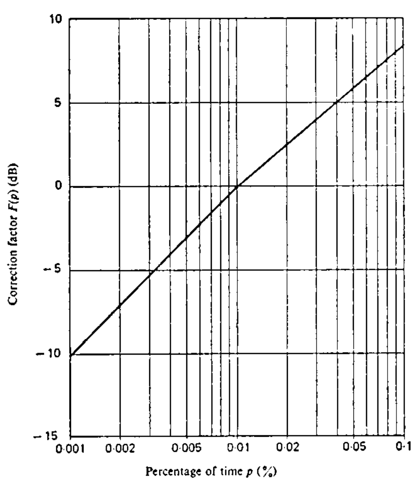
$F(p)$=correction factor (in dB) to relate the effective percentage of the time $p$ to 0.01 percent of the time, for great circle propagation mechanisms, as determined from figure 1 of this section;

$f$=frequency (in GHz);

$L_w$=receiving system transmission line loss (in dB); none to be assumed in calculation of coordination distance;

CORRECTION FACTOR $F(p)$ FOR PERCENTAGES OF THE TIME $p$ OTHER THAN 0.01%

CORRECTION FACTOR $F(p)$ FOR PERCENTAGES OF THE TIME $p$ OTHER THAN 0.01%




FCC § 25.253, Figure 1.

The following considerations apply to the selection of values for the parameters in this formula:

(1) The maximum gain of terrestrial antenna, either $G_t$ or $G_r$, is to be used in the formula above. The representative value contained in the appropriate column of table 1 of § 25.252 should be used.

(2) For an earth station communicating with geostationary satellites, the gain of the earth station antenna, either $G_r$ or $G_t$, is generally taken as the gain in the direction toward the physical horizon at the azimuth under consideration, except that in certain cases, as described in paragraph (f) of this section, where the elevation angle of the earth station antenna is below 12°, the main beam gain is used instead of the horizon gain. In the case of an earth station communicating with non-geostationary satellites, an equivalent time invariant gain should be used. This time invariant gain is taken as the greater of the maximum horizon gain minus 10 dB and the horizon gain not exceeded for more than 10 percent of the time.

(3) In those frequency bands where the potential for interference is from an earth station transmitter into a terrestrial receiver, a sensitivity factor $S$ in dBW may be defined in terms of the terrestrial antenna gain $G_m$ in dBi and the maximum permissible interference power $P_{max}(p)$ in dBW at the terrestrial receiver by

$$S=G_m-P_{max}(p)-L_w$$

With this definition, the formula for the normalized basic transmission loss may be rewritten as

$$L_o(0.01)=P_t+G_t+S-F(p)-20\log_{10}(f/4)$$

in terms of the parameters defined above. In this way, auxiliary contours, generated for sensitivity factor values of 5, 10, 15, 20 dB, etc. below the value corresponding to the main contour, may be convenient in performing preliminary interference analyses.

(4) In those frequency bands where the potential for interference is from a terrestrial transmitter into an earth station receiver, an equivalent isotropically radiated power $E$ in dBW may be defined in terms of the terrestrial transmitter power $P_m$ in dBW and

the terrestrial antenna gain $G_m$ in dBi by

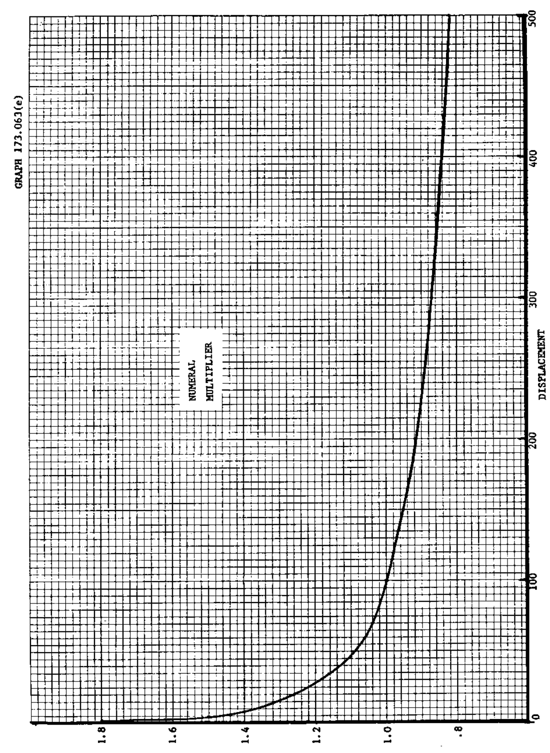
$$E=P_m+G_m$$

With this definition, the formula for the normalized basic transmission loss may be rewritten as

$$L_o(0.01)=E+G_r-P_{max}(p)-F(p)-20\log_{10}(f/4)-L_w$$

in terms of the parameters defined above. In this way, auxiliary contours, generated for equivalent isotropically radiated powers of 5, 10, 15, 20 dB, etc., below the value corresponding to the main contour, may be convenient in performing preliminary interference analyses.

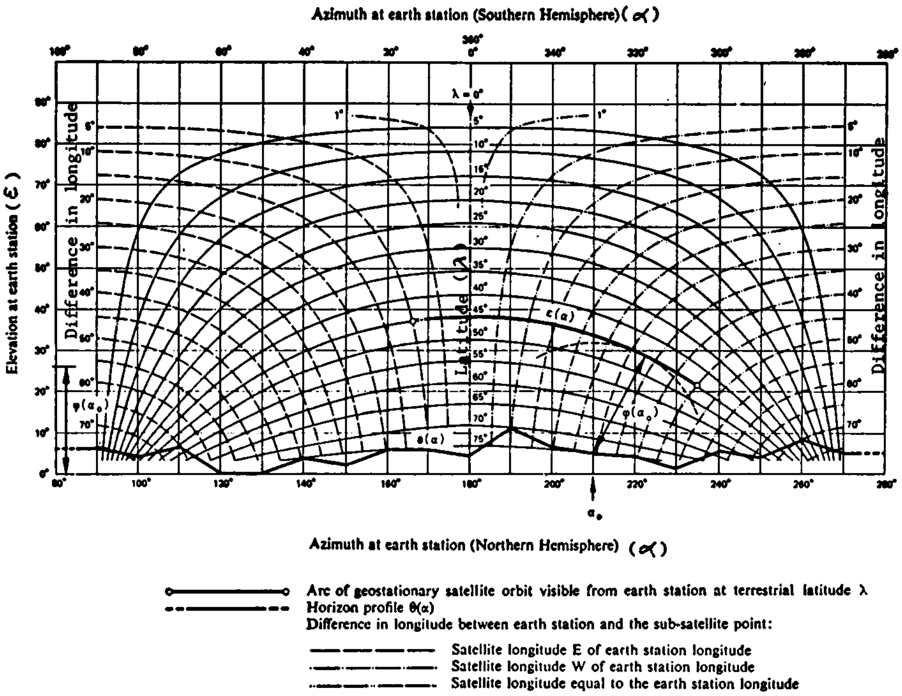
(b) The gain of the earth station antenna in the direction of the physical horizon around the earth station may be computed by the following method with the aid of figure 2 in the case of an earth station communicating with geostationary satellites. An example of this method is illustrated in figure 3 in the particular case of an earth station location at 45° north latitude for an azimuth of 210°




(1) Figure 2 shows the permissible location arcs of geostationary satellites in a rectangular azimuth-elevation plot ($\alpha$, $\varepsilon_3$), each arc corresponding to a particular earth station latitude, $\lambda$. For the latitude of the given earth station, that portion of the geostationary arc visible at the earth station for which coordination is to be effected is marked off between the appropriate limits. The example of figure 3 shows that portion of the arc of the geostationary orbit visible from an earth station at a latitude of 45° N. for the case of satellites located between 10° E. and 45° W. of the earth station.

(2) The horizon profile $\theta(\alpha)$ as a function of the azimuth $\alpha$ is then plotted along the bottom of figure 2 as illustrated in the example of figure 3.

EXAMPLE OF DERIVATION OF $\phi(\alpha_o)$




FCC § 25.253, FIGURE 3.

(3) At each azimuth interval (e.g. for each 5° of azimuth), the minimum angular distance $\phi(\alpha_o)$ (between the physical horizon at azimuth $\alpha_o$ and the plotted portion of the geostationary arc) is determined graphically, as illustrated in figure 3, using the elevation scale at the far left of the figure.

(4) The earth station gain toward the horizon at azimuth $\alpha_o$ may now be determined by evaluating either the actual earth station antenna pattern, if known, or the reference antenna pattern, if known, or the reference antenna pattern of § 25.209 at the minimum angular distance $\phi(\alpha_o)$.

(c) The dependence of basic transmission loss on climate is reflected in the definition of three radio-climatic zones:

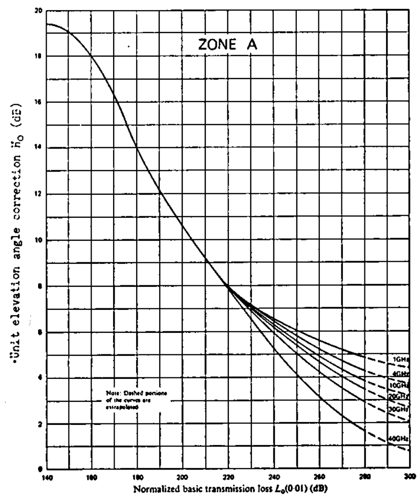
Zone A: Land;
Zone B: Sea at latitudes greater than 23.5° N. and 23.5° S.;
Zone C: Sea, at latitudes between 23.5° N. and 23.5° S., inclusive.

In addition, zones B and C are taken to extend inland, either to the distance at which the height of the terrain is 100 m above sea level, or 50 km inland, whichever is less.

(d) The coordination distance due to near great circle propagation mechanisms in a particular direction is calculated from the normalized basic transmission loss $L_o$ (0.01) computed from the formula of paragraph (a) of this section in the following manner:

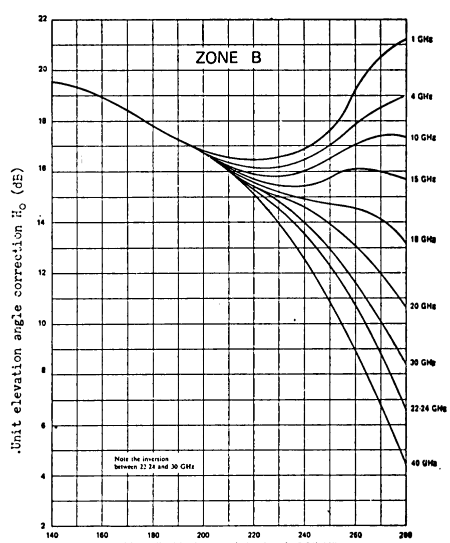
(1) Using the normalized basic transmission loss $L_o$ (0.01), a unit elevation correction $H_o$ (in dB) is obtained for the frequency under consideration from figure 4 for the appropriate radio-climatic zone. Linear interpolation between the curves of figure 4 is used for frequencies not shown.

UNIT ELEVATION ANGLE CORRECTION AS A FUNCTION OF NORMALIZED BASIC TRANSMISSION LOSS AND FREQUENCY, ZONE A



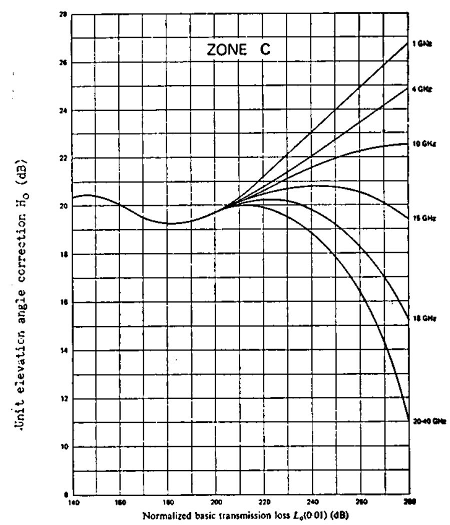

FCC § 25.253, FIGURE 4(a).

UNIT ELEVATION ANGLE CORRECTION AS A FUNCTION OF NORMALIZED BASIC TRANSMISSION LOSS AND FREQUENCY, ZONE B




FCC § 25.253, FIGURE 4(b).

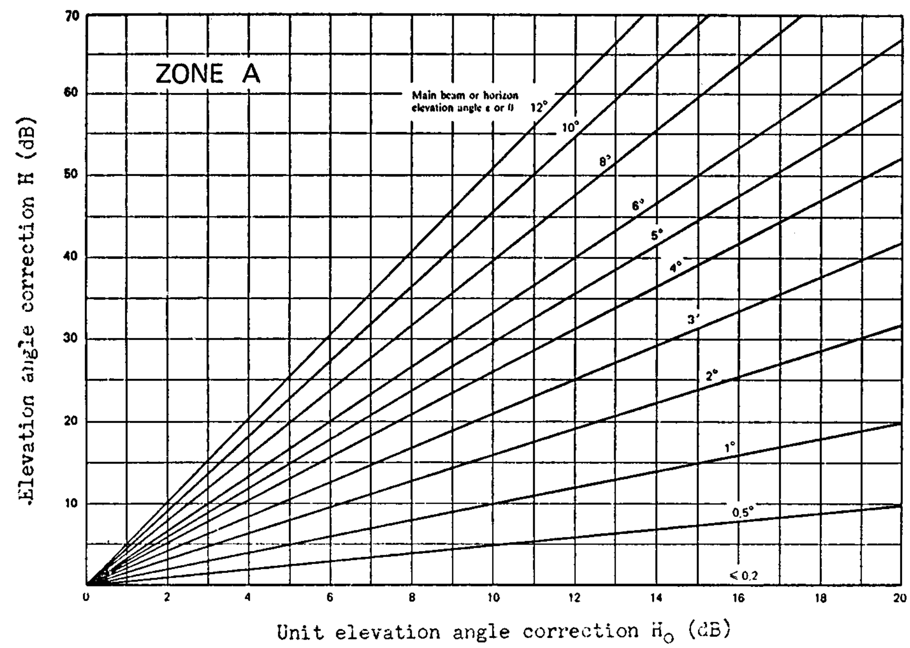
UNIT ELEVATION ANGLE CORRECTION AS A FUNCTION OF NORMALIZED BASIC TRANSMISSION LOSS AND FREQUENCY, ZONE C




FCC § 25.253, FIGURE 4(c).

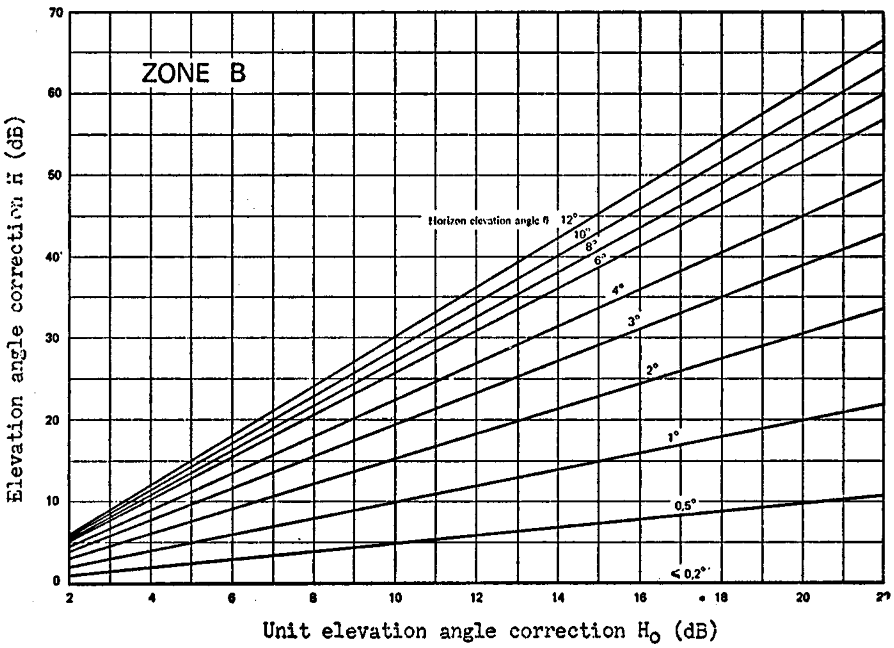
(2) This unit elevation correction $H_o$ together with the elevation angle of the physical horizon in the direction of azimuth under consideration is then used with figure 5 for the appropriate radio-climatic zone to obtain the total horizon correction $H$ (in dB). If the horizon elevation is less than 0.2°, the value of 0 dB is used for $H$.

ELEVATION ANGLE CORRECTION, ZONE A



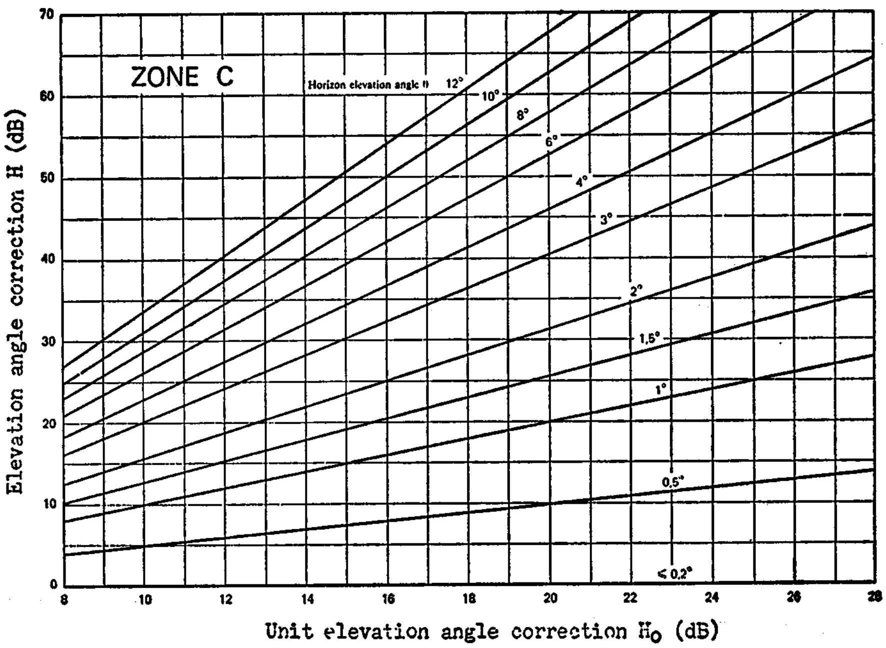

FCC § 25.253, FIGURE 5(a).

ELEVATION ANGLE CORRECTION, ZONE B




FCC § 25.253, FIGURE 5(b).

ELEVATION ANGLE CORRECTION, ZONE C



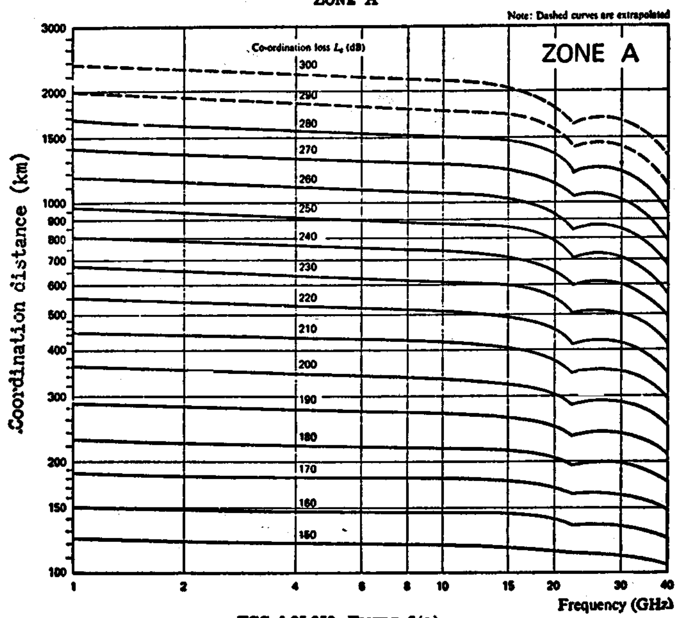

FCC § 25.253, FIGURE 5(c).

(3) The required coordination loss $L_c$ (in dB) is then calculated by subtracting the total horizon correction $H$ from the normalized basic transmission loss $L_o$ (0.01)

$$L_c = L_o(0.01) - H$$

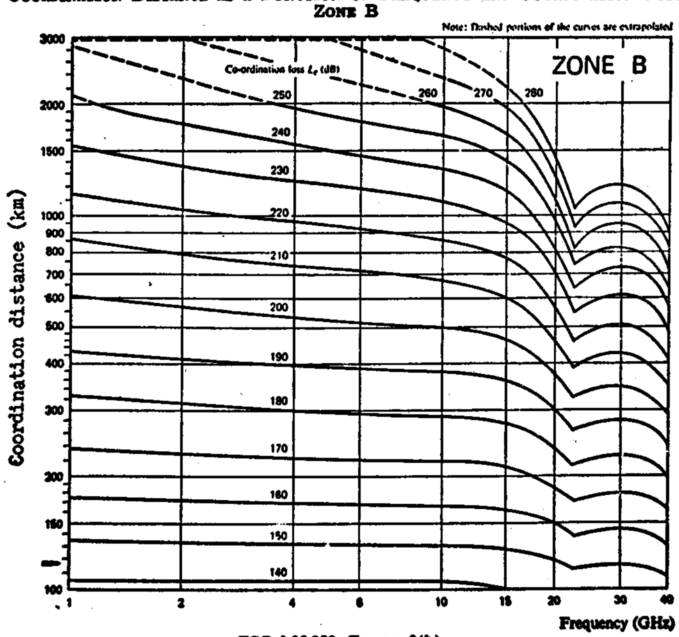
(4) The coordination distance for the radio-climatic zone in which the earth station is located can now be determined from figure 6 for the appropriate radio-climatic zone together with the required coordination loss $L_c$ and the frequency $f$.

COORDINATION DISTANCE AS A FUNCTION OF FREQUENCY AND COORDINATION LOSS, ZONE A



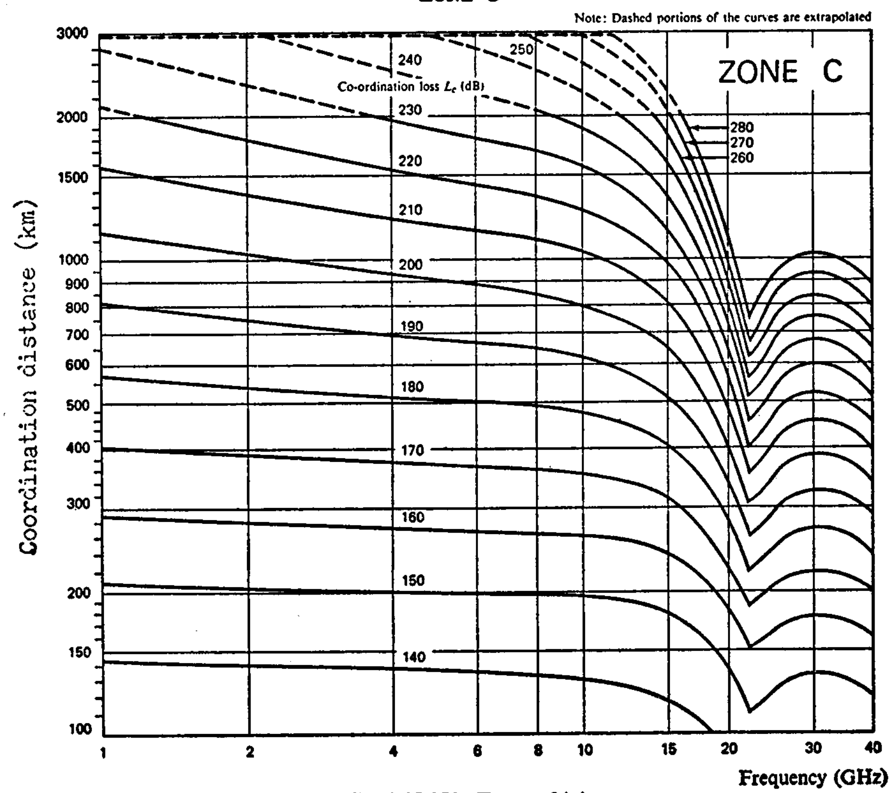

FCC § 25.253, FIGURE 6(a).

COORDINATION DISTANCE AS A FUNCTION OF FREQUENCY AND COORDINATION LOSS, ZONE B




FCC § 25.253, FIGURE 6(b).

COORDINATION DISTANCE AS A FUNCTION OF FREQUENCY AND COORDINATION LOSS, ZONE C




FCC § 25.253, FIGURE 6(c).

(5) For those azimuths for which the earth station antenna elevation angle is less than 12°, the coordination distance calculated in this manner may have to be adjusted in accordance with the procedure set forth in paragraph (f) of this section.

(e) When the coordination distance, calculated for the radio-climatic zone in which the earth station is located, extends into another radio-climatic zone, the effective multizone coordination distance is the sum of the distances $x_A$, $x_B$, and $x_C$ traversed by the radio path in zones A, B, and C, respectively, which are determined from the relationship

$$(x_A/D_A)+(x_B/D_B)+(x_C/D_C)=1$$

where $D_A$, $D_B$, and $D_C$ are the coordination distances in zones A, B, and C, respectively, calculated under the assumption that the radio path lies entirely in zones A, B, and C, respectively. The use of this relationship is illustrated by the following examples.

(1) Assume that the earth station is located in zone A and that a coordination distance $D_A$=345 km has been calculated assuming that the radio path lies only in zone A. However, in the particular direction being considered, the radio path crosses over into zone B at a distance of 290 km from the earth station. Assume further, that if the station were located in zone B, a coordination distance of $D_B$=530 km

would be required. Setting $x_C$=0, the relationship above can be solved for the unknown distance $x_B$ in zone B:

$$x_B=D_B\ [1-(x_A/D_A)]$$

By substituting the known values $x_A$=290 km, $D_A$=345 km and $D_B$=530 km, the required distance in zone *B* is found to be $x_B$=85 km. The effective coordination distance $d_c$ is then found to be

$$d_c=x_A+x_B=290+85=375\ \text{km}.$$

(2) Taking this same example one step further, assume that the radio path reenters zone *A* at a distance of 340 km from the earth station. In this case, the distance initially traversed by the radio path in zone *A* is know to be $x_A'$=290 km, and distance in zone *B* is $x_B=340-x_A'$=50 km. Therefore, it is necessary to solve for the remaining distance $x_A''$ in zone *A* by

$$x_A''=D_A[1-(x_B/D_B)]-x_A'.$$

Substituting the values for $D_A$, $x_B$, $D_B$, and $x_A'$, $x_A''$ is found to be

$$x_A''=345[1-(50/530)]-290=21\ \text{km}$$

so that the total lengths of the two segments of the radio path lying in zone A is

$$x_A=x_A'+x_A''=290+21=311\ \text{km}$$

and the effective coordination distance is

$$d_c=x_A+x_B=311+50=361\ \text{km}.$$

(f) The coordination distance calculated in paragraphs (d) and (e) of this section may be too small for those azimuths at which the elevation of the antenna of an earth station communicating with a geostationary satellite is below 12°. In these cases the following procedure is to be used to determine whether the regular coordination distance contour for each of these azimuths should be increased:

(1) A coordination distance *d′* is calculated for such an azimuth in the same manner as for the regular coordination distance $d_o$ from paragraph (d) of this section, except that:

(i) The main beam gain of the earth station antenna is used instead of the horizon gain,

(ii) The earth station antenna elevation angle for this azimuth is used instead of the horizon elevation angle,

(iii) The zone A curves of figures 4, 5, and 6 are used irrespective of the actual radio-climatic zone.

(2) If the coordination distance *d′* calculated in this manner is greater than the regular coordination distance $d_o$, the effective coordination distance $d_c$ for this azimuth is then taken as

$$d_c=d_o+[(d'-d_o)(12\text{-S})/7]\ \text{km}\ 5°\ 4\text{S}412°$$

where Σ is the earth station antenna elevation angle.

[38 FR 8577, Apr. 4, 1973, as amended at 39 FR 33527, Sept. 18, 1974]

### § 25.254 Computation of coordination distance contours for propagation modes associated with precipitation scatter.

(a) For a given pointing azimuth and elevation angle of an earth station antenna, a rain scatter coordination distance contour, calculated in accordance with the procedure set forth below takes the form of a circle of radius $d_{cr}$, the rain scatter coordination distance, centered at a point offset from the earth station location by a distance $D_r$ in the direction of azimuth of the main beam of the earth station antenna. This offset distance $D_r$ is a function of both the rain scatter distance $d_{cr}$ and the earth station antenna elevation angle. In the case of an earth station designed for operation with communication-satellites located at any point along a specified portion of the geostationary arc, this functional dependence entails the generation of rain scatter coordination distance contours for each azimuth direction in which the earth station antenna may point. The effective rain scatter coordination distance contour is then taken as the envelope defined by all these individual contours. It may be convenient to eliminate the need to consider multiple contours by taking an effective rain scatter coordination distance contour as a circle centered at the earth station location with a radius equal to the sum of the rain scatter distance $d_{cr}$ and the maximum offset distance $D_r$ at the minimum elevation angle. Such a procedure is conservative, since the resulting contour will always be larger than necessary, but for earth stations having minimum elevation angles above 20°, the increase in area inside the contour will be small.